



U.S. Department of Energy

**Office of River Protection**

0058586

P.O. Box 450  
Richland, Washington 99352

02-ED-031

DEC 13 2002

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Air Emissions and Defense  
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State of Washington  
Department of Health  
P.O. Box 47827  
Olympia, Washington 98504

**RECEIVED**  
JAN 23 2003

**EDMC**

Addressees:

**RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION (NOC) APPLICATION  
FOR INSTALLATION AND OPERATION OF WASTE RETRIEVAL SYSTEMS IN SINGLE-  
SHELL TANK (SST) 241-U-107**

Attached for the State of Washington Department of Health (WDOH) and the U.S. Environmental Protection Agency (EPA) review and formal approval are the notification of off-permit change (Attachment 1) and the subject NOC (Attachment 2). The NOC is being submitted in accordance with the Washington Administrative Code 246-247, "Radiation Protection of Air Emissions," and Title 40 Code of Federal Regulations, Part 61, "National Emission Standards for Hazardous Air Pollutants."

Initial saltcake dissolution is being done under NOC DOE/RL-97-09, Revision 6, December 18, 2000. This NOC is to install and operate additional equipment to complete the retrieval effort.

This NOC is for the installation and operation of a saltcake dissolution and waste retrieval system in SST 241-U-107. This NOC application is similar to DOE/RL-97-09, "Radioactive Air Emissions Notice of Construction Use of a Portable Exhauster on Single-Shell Tanks During Salt Well Pumping," which was previously approved by WDOH and the EPA. If possible, we would like to receive the draft approval conditions by March 1, 2003, to support the project schedule's date for NOC approval by March 14, 2003. The U.S. Department of Energy, Office of River Protection and CH2M HILL Hanford Group, Inc. stand ready to support an accelerated review and approval.

If you have any questions, please contact Dennis W. Bowser, of my staff, (509) 373-2566.

Sincerely,

James E. Rasmussen, Director  
Environmental Division

ED:DWB

Attachments: (2)

cc: See page 2

Mr. A. W. Conklin  
02-ED-031

-2-

DEC 13 2002

cc w/o attaches:

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Administrative Record

Attachment 1  
02-ED-031

Hanford Site Air Operating Permit Notification of  
Off-Permit Change

## HANFORD SITE AIR OPERATING PERMIT

### Notification of Off-Permit Change

Permit Number: 00-05-006

This notification is provided to Washington State Department of Ecology, Washington State Department of Health, and the U.S. Environmental Protection Agency as notice of an off-permit change described as follows.

This change is allowed pursuant to WAC 173-401-724(1) as:

1. Change is not specifically addressed or prohibited by the permit terms and conditions
2. Change does not weaken the enforceability of the existing permit conditions
3. Change is not a Title I modification or a change subject to the acid rain requirements under Title IV of the FCAA
4. Change meets all applicable requirements and does not violate an existing permit term or condition
5. Change has complied with applicable preconstruction review requirements established pursuant to RCW 70.94.152.

Provide the following information pursuant to WAC-173-401-724(3):

#### Description of the change:

Submittal of *Radioactive Air Emissions Notice Of Construction Application For Installation And Operation Of Waste Retrieval Systems In Single-Shell Tank 241-U-107*. This Notice of Construction allows for a system to be installed into Single Shell Tank 241-U-107 which will utilize water in a controlled fashion to dissolve and/or mobilize waste in the tank for retrieval by pumping to the Double-Shell Tank System.

**Date of Change:** To be provided in the agency approval order.

The date the approval order is issued by Washington State Department of Health.

#### Describe the emissions resulting from the change:

The total effective dose equivalent (TEDE) from all calendar year 2001 Hanford Site air emissions (point sources and diffuse and fugitive sources) was 0.49 mrem (DOE/RL-2002-20). The potential unabated emissions from all associated activities for the 241-U-107 Retrieval Project are estimated to be 83 mrem/year total effective dose equivalent to the hypothetical onsite maximally exposed individual. Abated emissions are estimated to be 0.047 mrem/year.

**Describe the new applicable requirements that will apply as a result of the change:** To be provided in the agency approval order.

Conditions and limitations will be those identified in the approved order when issued by Washington State Department of Health.

#### For Hanford Use Only:

AOP Change Control Number:

Date Submitted:

**Attachment 2**  
**02-ED-031**

**Notice of Construction for the Installation and Operation  
of a Saltcake Dissolution and Waste Retrieval System  
in Tank 241-U-107**

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## TERMS

ALARACT	as low as reasonably achievable control technology
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
DST	double-shell tank
EPA	U.S. Environmental Protection Agency
HEPA	high-efficiency particulate air
HIHTL	hose-in-hose transfer line
MEI	maximally exposed individual
MPR	maximum public receptor
NOC	notice of construction
RPP	River Protection Project
SEPA	State Environmental Policy Act
SHMS	Standard Hydrogen Monitoring System
SST	single-shell tank
TEDE	total effective dose equivalent
WAC	<i>Washington Administrative Code</i>
WDOH	Washington State Department of Health

## METRIC CONVERSION CHART

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
<b>Length</b>			<b>Length</b>		
Inches	25.40	Millimeters	millimeters	0.0393	Inches
Inches	2.54	Centimeters	centimeters	0.393	Inches
Feet	0.3048	Meters	meters	3.2808	Feet
Yards	0.914	Meters	meters	1.09	Yards
Miles	1.609	Kilometers	kilometers	0.62	Miles
<b>Area</b>			<b>Area</b>		
square inches	6.4516	Square centimeters	square centimeters	0.155	Square inches
square feet	0.092	square meters	square meters	10.7639	Square feet
square yards	0.836	square meters	square meters	1.20	Square yards
square miles	2.59	Square kilometers	square kilometers	0.39	Square miles
Acres	0.404	Hectares	hectares	2.471	Acres
<b>Mass (weight)</b>			<b>Mass (weight)</b>		
Ounces	28.35	Grams	grams	0.0352	ounces
Pounds	0.453	Kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
<b>Volume</b>			<b>Volume</b>		
fluid ounces	29.57	Milliliters	milliliters	0.03	fluid ounces
Quarts	0.95	Liters	liters	1.057	Quarts
Gallons	3.79	Liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards
<b>Temperature</b>			<b>Temperature</b>		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
<b>Force/Pressure</b>			<b>Force/Pressure</b>		
pounds per square inch	6.895	Kilopascals	kilopascals	1.4504 x 10 <sup>-1</sup>	pounds per square inch

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

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## INTRODUCTION

This document serves as a notice of construction (NOC), in accordance with Washington Administrative Code (WAC) 246-247-060, and as a request for approval, in accordance with 40 Code of Federal Regulations (CFR) 61.07, for the installation and operation of a waste retrieval system in Single-Shell Tank (SST) 241-U-107. The system will utilize water in a controlled fashion to dissolve and/or mobilize waste in the tank for retrieval by pumping to the Double-Shell Tank System.

The total effective dose equivalent (TEDE) from all calendar year 2001 Hanford Site air emissions (point sources and diffuse and fugitive sources) was 0.49 mrem (DOE/RL-2002-20). The emissions resulting from the activities covered by this NOC, in conjunction with other operations on the Hanford site, will not exceed the National Emission Standard of 10 millirem per year (40 CFR 61, Subpart H). The potential unabated emissions from all associated activities for the 241-U-107 Retrieval Project are estimated to be 83-mrem/year total effective dose equivalent to the hypothetical onsite maximally exposed individual. Abated emissions are estimated to be 0.047 mrem/year. Activities that contribute to this estimate include pit entries, excavation work, and active and passive ventilation. This estimate is conservative for purposes of bounding the project activities. The duration of project activities is expected to be less than 3 years and the anticipated start of construction is January 2003.

This application also intends to provide notification of anticipated initial start-up, in accordance with 40 CFR 61.09 (a)(1). It is requested that approval of this application will also constitute Environmental Protection Agency (EPA) acceptance of the initial start-up notification. Written notification of the actual date of initial start-up, in accordance with 40 CFR 61.09(a)(2), will be provided at a later date.

## 1.0 FACILITY IDENTIFICATION AND LOCATION

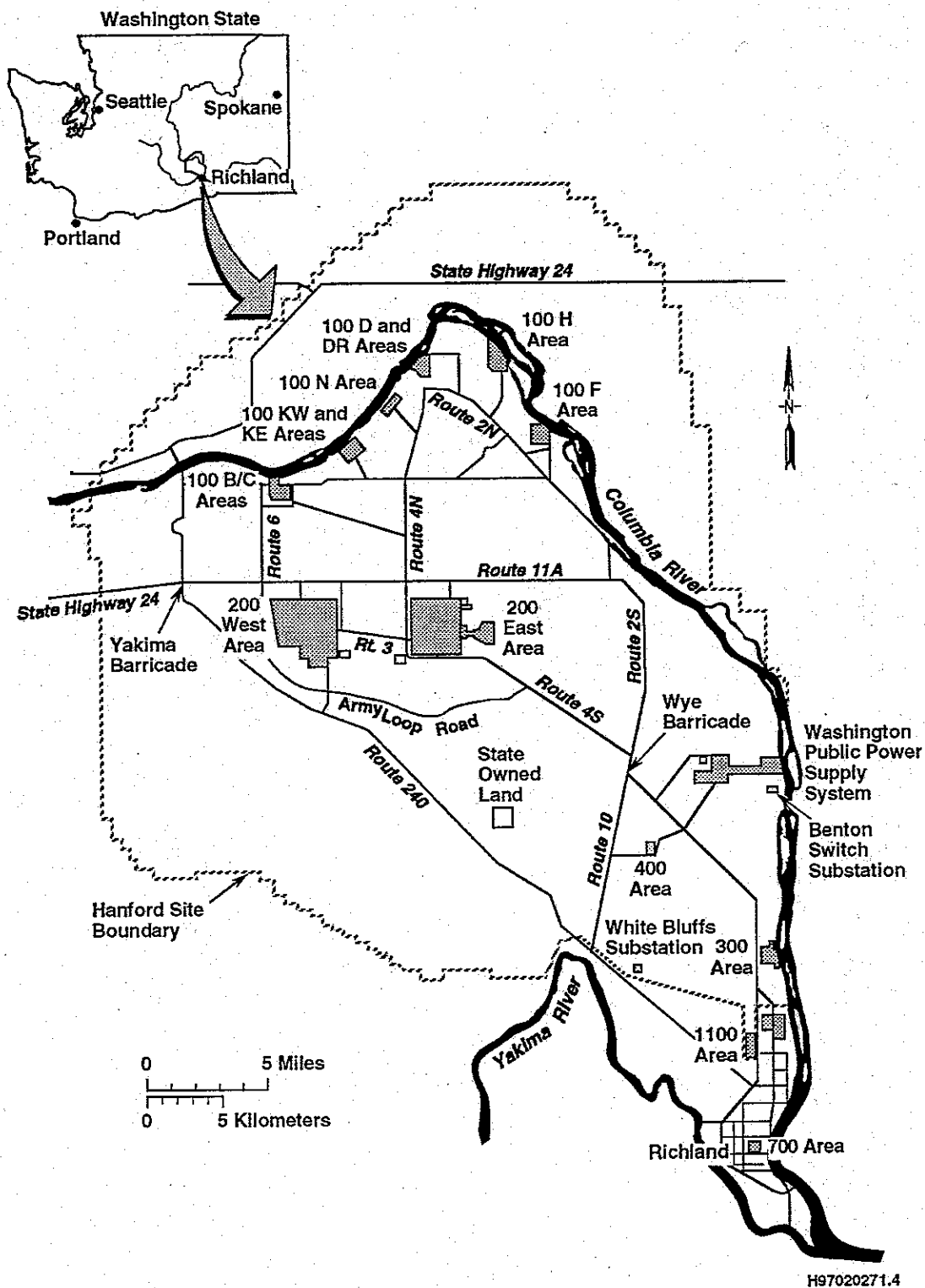
*Regulatory Citation: Name and address of the facility, and location (latitude and longitude) of the emission unit(s).*

The 241-U-107 Tank is located in the U. S. Department of Energy Hanford Site, 200 West Area, Richland, Washington. The 241-U Tank Farm Facility is managed and operated by CH2M HILL Hanford Group, Inc., for the Office of River Protection (ORP) under contract DE-AC06-99RL-14047.

Coordinates:	Latitude:	46 deg.N 32 min. 46 sec.
	Longitude:	119 deg.W 37 min. 42 sec.

Figure 1 shows the location of the 200 West and 200 East Areas within the Hanford Site. Figure 2 shows the location of the 241-U-Tank Farm where Tank 241-U-107 is located.

Figure 1. Location of the 200 West and 200 East Areas Within the Hanford Site.



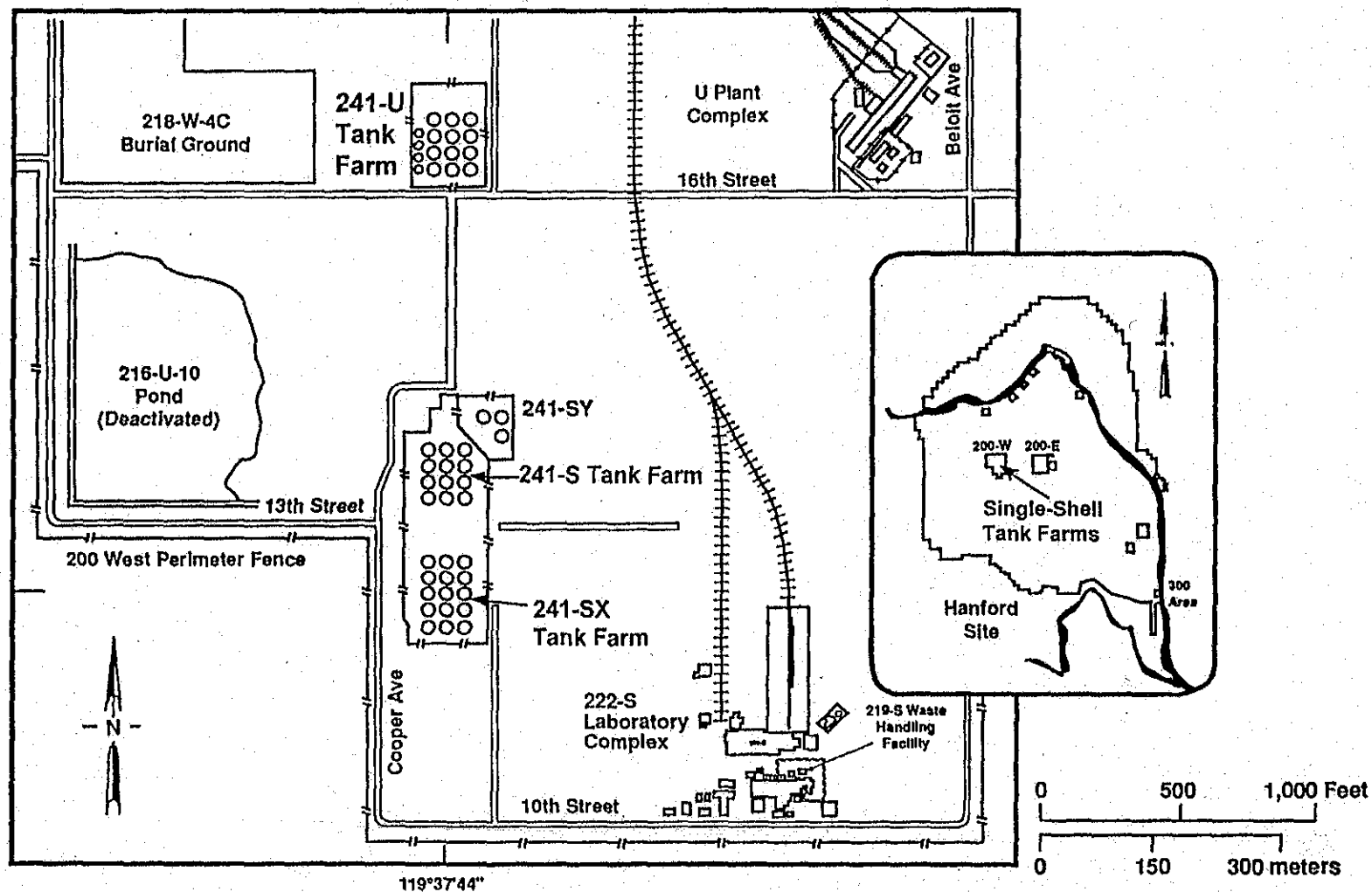


Figure 2. Location of the 241-U Tank Farm.

H96070161.37b

## 2.0 RESPONSIBLE MANAGER

*Regulatory Citation: Name, title, address, and phone number of the responsible manager.*

Mr. R. J. Schepens, Manager  
U.S. Department of Energy, Office of River Protection  
P.O. Box 450  
Richland, Washington, 99352  
(509) 376-6677

## 3.0 PROPOSED ACTION

*Regulatory Citation: Identify the type of proposed action for which this application is submitted: (a) Construction of new emission units(s); (b) Modification of existing emission units(s); identify whether this is a significant modification; (c) Modification of existing unit(s), unregistered.*

The proposed action is a significant modification to the existing tank, 241-U-107. Significant is defined in WAC 246-247-030 as "the potential-to-emit airborne radioactivity at a rate that could increase the TEDE to the MEI by at least 1.0 mrem/yr as a result of a proposed modification." The objective of the 241-U-107 Retrieval Project is to use water in a controlled fashion to dissolve and/or mobilize waste in the tank for retrieval by pumping to the Double-Shell Tank (DST) System. The modification will include the following activities:

- Preparatory work
  - Access to various pits for equipment removal and installation
  - Removal/installation of various tank equipment and instrumentation
  - Installation of an exhauster
  - Soil excavation for electrical conduit
- Operation
  - Operation of the exhauster
  - Operation of the water distribution system and waste transfer pump

## 4.0 STATE ENVIRONMENTAL POLICY ACT OF 1971

*Regulatory Citation: If this project is subject to the requirements of the State Environmental Policy Act (SEPA) contained in chapter 197-11 WAC, provide the name of the lead agency, lead agency contact person, and their phone number.*

The proposed action is categorically exempt from the requirements of the *State Environmental Policy Act* under WAC 197-11, "SEPA Rules, Section WAC 197-11-845, Department of Social and Health Services."

## **5.0 CHEMICAL AND PHYSICAL PROCESS**

*Regulatory Citation: Describe the chemical and physical processes upstream of the emission unit(s).*

### **5.1 PREPARATORY WORK**

#### **5.1.1 Pit Work**

The 241-UR-07B Central Pump Pit and another 241-U-107 pit will be accessed in the 241-U-107 Retrieval Project. The 241-UR-07B Central Pump Pit will be accessed approximately three times for the removal of a saltwell screen and pump and subsequent installation of an instrumentation manifold and waste transfer pump. The saltwell screen and pump is approximately 36 feet long by 10 inches in diameter and may be cut into sections to ease disposal. Another 241-U-107 pit may be accessed for the replacement of a cover plate to facilitate the connection of the exhaust trunk for a portable exhauster or the exhaust trunk may be attached to an available riser. Most items will be removed or installed with a crane.

#### **5.1.2 Riser Work**

Spray devices have been installed in 241-U-107 as described in DOE/RL-97-09. Additional spray devices may be inserted into other tank risers as necessary following initial dissolution operations. Video cameras may also be installed into other tank risers. Any equipment currently installed in those risers would then be removed or relocated to accommodate these items. Equipment currently installed that may be removed or relocated includes, but is not limited to, the Liquid Observation Well (LOW). The LOW is approximately 37 feet long and 3 inches in diameter and may be cut into sections to ease disposal. Most items will be removed or installed with a crane.

#### **5.1.3 Ventilation Installation**

A HEPA inlet filter and portable exhauster will be installed for the ventilation of 241-U-107 during saltcake dissolution and waste transfer. An exhaust trunk will connect with the portable exhauster as discussed in Section 5.1.1. Pit Work.

#### **5.1.4 Soil Excavation**

Soil will be excavated inside the 241-U Tank Farm to accommodate electrical and instrumentation conduit to monitor transfer progress. Soil excavation will occur outside the 241-U Tank Farm for conduit and transformer installation if an electrical upgrade is needed. Up to 1000 feet of intermittent trenching will generate up to 1000 cubic feet of excavated soil. Approximately seventy percent of the soil excavation will occur inside the tank farm and thirty percent outside the tank farm. Soil will be excavated with hand tools and clean soil may be moved with heavy equipment (backhoe, front-end loader, etc.). Soil excavation and backfill will generally be continuous to cover conduit and/or water/air pipe runs.

## 5.2 OPERATION

Operation will consist of the water distribution system, waste transfer pump, and optional use of an exhauster. A portable exhauster will be connected and may be operated as needed to provide improved visibility during saltcake dissolution and waste transfer. The ventilation installation was discussed in Section 5.1.3.

A water distribution system will introduce water into 241-U-107 to dissolve the soluble waste and mobilize the insoluble waste. The water distribution skid will be positioned near to or on top of 241-U-107 with one inlet line connection from the raw water line in 241-U Tank Farm. The raw water line will provide water at approximately 70 lb/in<sup>2</sup> and adequate flow rates to the water distribution skid under normal operating conditions. Total flow from the skid will be approximately 80 to 100 gallons per minute (gpm) if a 2-inch line is used or 130 to 220 gpm if a 3-inch line is used. The water will be distributed through spray nozzle devices located in various risers. These devices are planned to operate at a flow rate 35 to 80 gpm each. The water passes through a flow meter/totalizer before supplying each of the water distribution spray nozzle devices.

The resulting dissolved/mobilized waste solution will be pumped and transferred to the 241-SY Tank Farm via transfer lines. The 241-U-107 Project will interface with various components in the 241-U Tank Farm and the 241-SY Tank Farm. Flexible jumpers and manifolds in the associated pit structures provide the necessary connections between the various transfer line segments.

## 6.0 ABATEMENT TECHNOLOGY

*Regulatory Citation: Describe the existing and proposed (as applicable) abatement technology. Describe the bases for the use of the proposed system. Include expected efficiency of each control device, and the annual average volumetric flow rate(s) in meters<sup>3</sup>/sec for the emission units(s).*

### 6.1 EXISTING ABATEMENT TECHNOLOGY

A passive breather filter is currently installed in a G-1 style housing (see Figure 4) on Riser R-10 of 241-U-107. This passive ventilation system produces a variable flow rate through the tank, which is primarily dependent upon atmospheric pressure fluctuations and temperature difference between the tank headspace and atmosphere. The nominal passive ventilation flow rate for 241-U-107 is 10ft<sup>3</sup>/min (HNF-SD-WM-TI-797).

### 6.2 PROPOSED ABATEMENT TECHNOLOGY

The proposed activities listed in Section 3.0 Proposed Action and discussed further in Section 5.0 Chemical and Physical Process will be abated with various As Low As Reasonably Achievable Control Technologies (ALARACT) and further filtration on the portable exhauster during active ventilation. The proposed abatement technology is discussed further in the following sections.

#### 6.2.1 Pit Work Abatement Technology

Pit access and work will be performed in accordance with as low as reasonably achievable control technology (ALARACT) Demonstrations 6 and 14, *TWRS ALARACT Demonstration for*

*Pit Access and TWRS ALARACT Demonstration for Pit Work (HNF-4327).* Equipment installation and removal will be performed in accordance with ALARACT Demonstration 13, *TWRS ALARACT Demonstration for Installation, Operation, and Removal of Tank Equipment (HNF-4327).* Disposition of excess equipment and waste will be performed in accordance with ALARACT Demonstration 4, and ALARACT 15, *TWRS ALARACT Demonstration For Packaging and Transportation of Waste*, and *TWRS ALARACT Demonstration For Size Reduction of Waste Equipment for Disposal.* Work on the exhaust trunk will be performed in accordance with ALARACT Demonstration 16, *TWRS ALARACT Demonstration For Work On Potentially Contaminated Ventilation System Components.*

#### **6.2.2 Riser Work Abatement Technology**

Equipment installation and removal during riser work will be performed through risers in accordance with ALARACT(s) 4, 13, and 15.

#### **6.2.3 Ventilation Installation Abatement Technology**

The installation of a HEPA inlet filter and portable exhauster will be performed in accordance with ALARACT 16.

#### **6.2.4 Soil Excavation Abatement Technology**

Soil excavation activities will be performed in accordance with ALARACT Demonstration 5, *TWRS ALARACT Demonstration for Soil Excavation (Using Hand Tools)*, and will follow the radiological controls specified in that ALARACT.

#### **6.2.5 Operation Abatement Technology**

An interim stabilization (IS) portable exhauster 296-P-43 (or similar exhauster), approved by WDOH (AIR 98-1207) December 16, 1998, or a rotary mode core sampling (RMCS) exhauster 296-P-34 (or similar exhauster), approved by WDOH (AIR 98-301) March 6, 1998, may be used for ventilation during saltcake dissolution and the waste transfer period of 241-U-107. Figure 5 is a depiction of the IS exhauster, which is designed to operate at flow rates up to 500 ft<sup>3</sup>/min (0.24 cubic meters per second). The RMCS exhauster has a similar configuration and is designed to operate at flow rates up to 250 ft<sup>3</sup>/min (0.12 cubic meters per second). The major system components of the exhausters are as follows:

- Stack
- Glycol heaters
- 1 pre-filter
- 2 HEPA filters
- 1 exhaust fan
- Sampling system.

During operation of the portable exhauster air from the tank will be heated to reduce the relative humidity prior to entering the filters. The air will pass through the pre-filter, two HEPA filters in series, a fan and discharge through a stack. The exhaust stack houses the air velocity probe (for measurement of stack velocity) and the air-sampling probe. Any moisture that might accumulate inside the exhauster will be collected in a drain system, routed to a seal pot, and returned to the tank. Flexible ductwork will be used to connect the exhauster inlet to the tank riser.

The pre-filter traps large airborne particles to increase the life of the HEPA filters. The HEPA filters will have a minimum particle collection efficiency of 99.95 percent for 0.3  $\mu$ m median

diameter. The HEPA filter housing will provide a sealed barrier for the confinement of airborne radionuclides and will serve to encapsulate and hold the HEPA filter. The filter housing will meet the applicable sections of American Society of Mechanical Engineers (ASME) AG-1, Section FC, ASME N509, and will be tested annually to requirements of ASME N510 or equivalent. Filter housings are leak tested using the pressure decay method in accordance with ASME N510. Test sections are provided to allow for in-place testing of the HEPA filters. The exhaust fan is constructed of non-sparking materials and will meet Air Movement and Control Association Standard 99-0401-86 and is Type A construction. The fan is a centrifugal type and is statically and dynamically balanced as an assembly. See Appendix D for annual possession quantities, emissions, and doses associated with active ventilation.

During passive ventilation, the portable exhauster will be valved off and air will enter or exit the tank through the breather filters, depending on tank internal pressure relative to atmospheric pressure. Each breather filter will consist of a housing that contains a HEPA filter, an outlet screen, and a small seal loop. During passive ventilation, an isolation valve will normally be open to allow airflow between the tank vapor space and the outside atmosphere through the filter. Air flowing to and from the tank will pass horizontally through the filter and vertically through the downward-facing exit weather hood.

Figure 3 shows breather filter configuration on a typical SST. Figure 4 shows components of a typical "open face" style of housing and a "G-1" style of housing breather filter. Current plans are to use the "G-1" style of housing. Figure 5 shows a typical ventilation system. See Appendix E for annual possession quantities, emissions, and doses associated with passive ventilation.

## 7.0 DRAWING OF CONTROLS

*Regulatory Citation: Provide conceptual drawings showing all applicable control technology components from the point of entry of radionuclides into the vapor space to release to the environment.*

The following figures (3 through 5) depict a typical SST, typical passive ventilation and a typical active ventilation system.

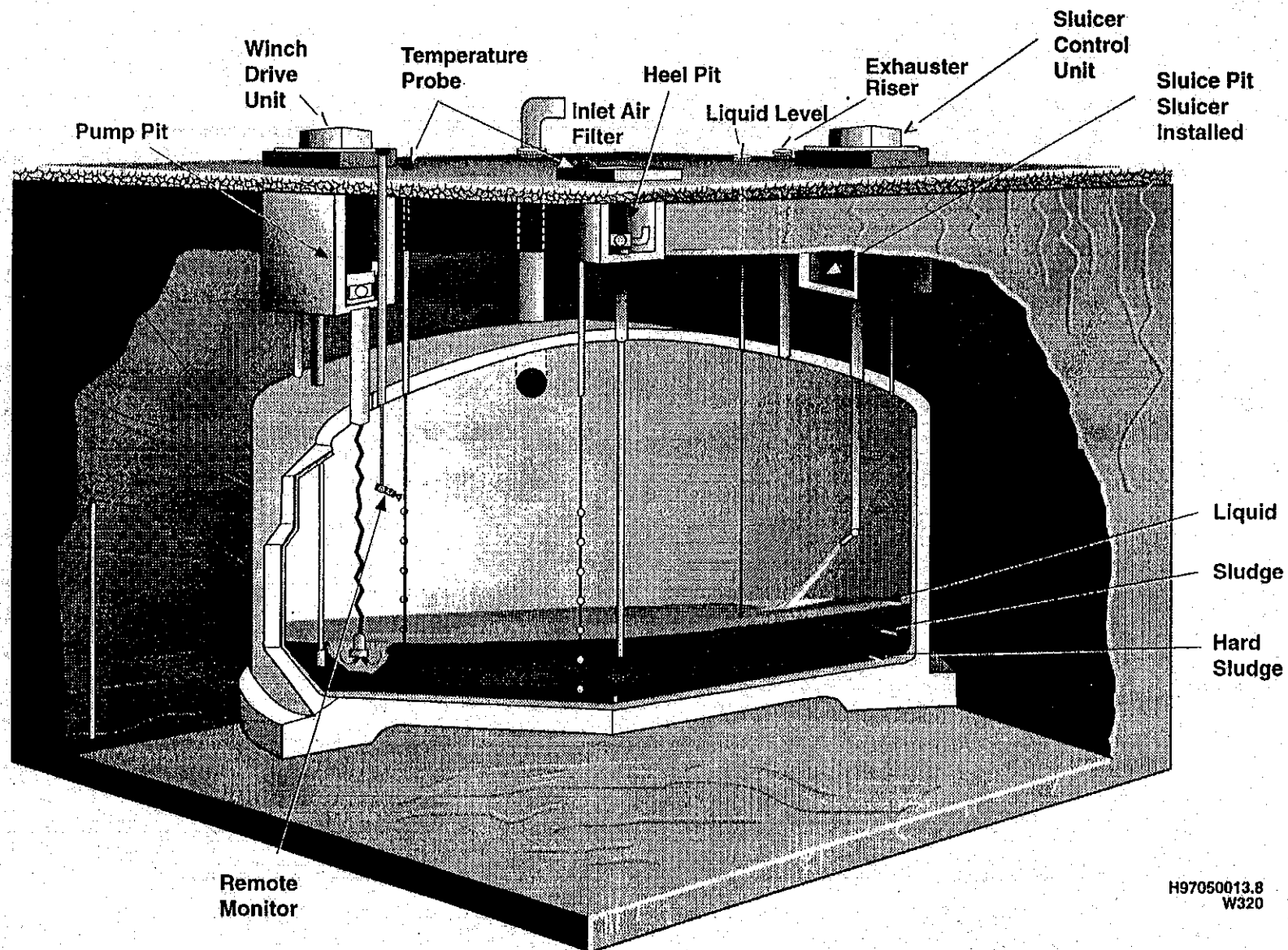


Figure 3. Typical Single-Shell Tank

H97050013.8  
W320

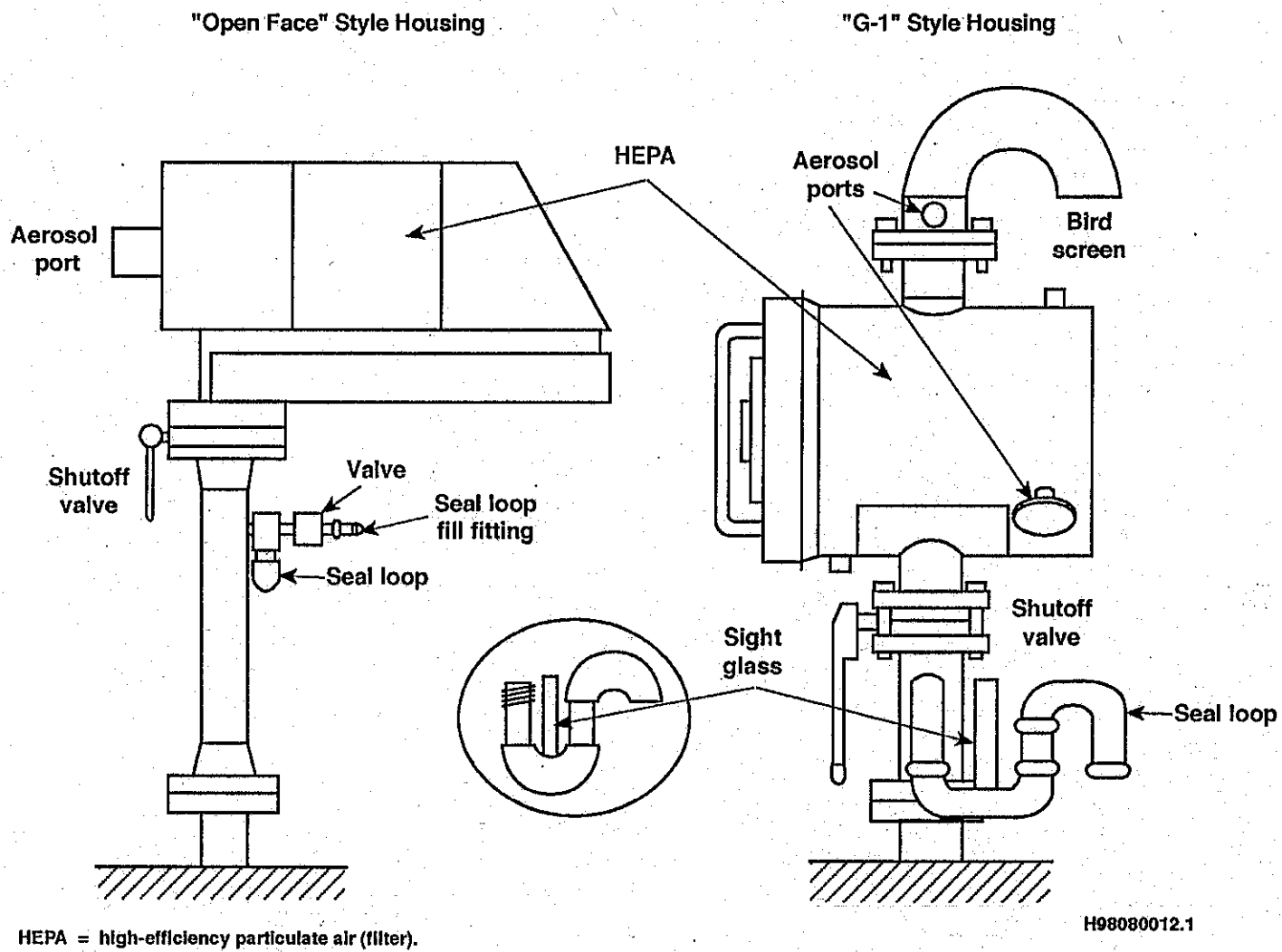
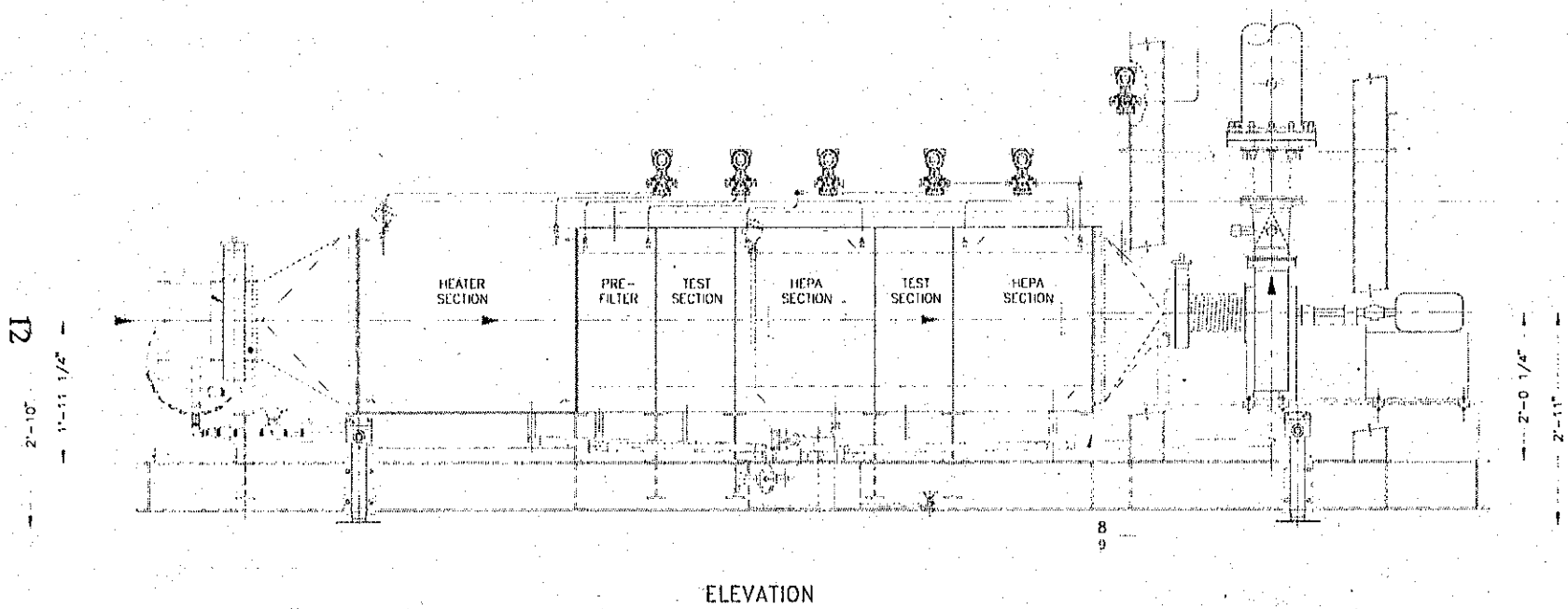


Figure 4. Typical Breather Filter Configuration.

Figure 5. Typical Ventilation System.



## 8.0 RADIONUCLIDES OF CONCERN

*Regulatory Citation: Identify each radionuclide that could contribute greater than ten percent of the potential-to-emit TEDE to the MEI, or greater than 0.1 mrem/yr potential-to-emit TEDE to the MEI.*

Radionuclides that could contribute greater than 10 percent of the potential-to-emit TEDE to the maximally exposed individual (MEI) or greater than 0.1 mrem/yr potential-to-emit TEDE to the MEI are: Cs-137, Pu-238, Pu-239, Pu-240, and Am-241. The results for these and all radionuclides are shown in columns G and H of Appendix D.

## 9.0 EFFLUENT MONITORING SYSTEM

*Regulatory Citation: Describe the effluent monitoring system for the proposed control system. Describe each piece of monitoring equipment and its monitoring capability, including detection limits, for each radionuclide that could contribute greater than ten percent of the potential-to-emit TEDE to the MEI, or greater than 0.1 mrem/yr potential-to-emit TEDE to the MEI, or greater than twenty-five percent of the TEDE to the MEI, after controls. Describe the method for monitoring or calculating those radionuclide emissions. Describe the method with detail sufficient to demonstrate compliance with the applicable requirements.*

The potential unabated total effective onsite dose for all associated activities for the 241-U-107 Retrieval Project is 83 mrem/year. Of this total, the majority of the emissions occur during exhauster operation, the remainder of the activities contributing less than 0.1 mrem/year. Therefore, in accordance with 40 CFR 61, Subpart H, continuous monitoring will be performed during exhauster operation to verify emissions. As noted in Appendix D, column H, Cs-137 contributes greater than ten percent of the potential-to-emit TEDE to the MEI. In addition to that, column G of Appendix D notes contributions of Cs-137, Pu-238, Pu-239, Pu-240, and Am-241 are greater than 0.1 mrem/yr potential-to-emit TEDE to the MEI. Column K of Appendix D also estimates that Cs-137 will contribute greater than twenty-five percent of the TEDE to the MEI after controls. A representative sample of these radionuclides will be collected in the record sample collection system and analyzed in the laboratory. Results will be published in the annual Hanford Site Emission reports. The quality and detection limits of these analyses are controlled via the current revisions of the following documents:

HNF-EP-0528, NESHAP Quality Assurance Project Plan for Radioactive Air Emissions

HNF-EP-0835-8, Statement of Work for Services Provided by the Waste Sampling and Characterization Facility for the Environmental Compliance Program during calendar year 2002.

RPP-QAPP-004, Quality Assurance Program Plan for Tank Farm Contractor Radioactive Air Emissions.

## 9.1 PREPARATORY WORK MONITORING

Monitoring will be performed in accordance with ALARACT(s) cited in Section 6.0 Abatement Technology. Actual and calculated emissions from pit work and soil excavation will be tracked on log sheets.

## 9.2 OPERATIONS MONITORING

The monitoring system used on any portable exhauster employed in this project will meet the regulatory compliance requirements specified in 40 CFR 61, Subpart H and its referenced requirements.

The portable exhauster will sample and monitor the emissions continuously during operation. The system will collect its sample via an isokinetic or shrouded probe. The probe installation location and the transport lines will be designed and qualified to adhere to the applicable requirements of ANSI/HPS N13.1-1999.

Periodic Confirmatory Measurement will be conducted annually by verifying the levels of smearable contamination of the inside surface of the ducting downstream of the HEPA filter or on the outside of the screen covering the outlet of the vent, should one exist. Confirmation of levels below 10,000 disintegrations per minute per 100 square centimeters beta/gamma and 200 disintegrations per minute per 100 square centimeters alpha will be used to verify low emissions. Detected levels above these thresholds would result in further investigation and reporting if the cause was due to an airborne emission. The radiological survey reports will become the record for the periodic confirmatory measurement.

## 10.0 ANNUAL POSSESSION QUANTITY

*Regulatory Citation: Indicate the annual possession quantity for each radionuclide.*

Annual Possession Quantity in Tank U-107 consists of radionuclides listed in Table 1. The analyte list and data listed in Table 1 are from the Tank Waste Information Network System 3 (TWINS3) database, Best Basis Inventory, Best Basis Summary as of December 4, 2002.

Table 1. Tank Inventory Data for Tank 241-U-107			
Analyte	U-107 Inventory	Analyte	U-107 Inventory
Equations		Equations	
	Ci		Ci
	A		A
3H	3.00E+02	226Ra	1.76E-04
14C	6.01E+01	228Ra	6.61E-02
60Co	1.23E+00	227Ac	1.83E-03
59Ni	1.59E+01	229Th	2.97E-03
63Ni	1.15E+02	232Th	1.34E-02
79Se	3.92E-01	231Pa	4.84E-03
90Sr	5.47E+03	232U	3.29E-02

Table 1. Tank Inventory Data for Tank 241-U-107			
Analyte	U-107 Inventory	Analyte	U-107 Inventory
	Ci		Ci
Equations	A	Equations	A
90Y	5.47E+03	233U	1.35E-01
93Zr	1.93E+01	234U	3.30E-01
93mNb	1.56E+01	235U	1.40E-02
99Tc	5.10E+02	236U	7.63E-03
106Ru	6.00E-05	238U	3.19E-01
113mCd	7.15E+01	237Np	1.87E+00
126Sn	2.37E+00	238Pu	1.03E+01
125Sb	3.35E+01	239Pu	6.31E+02
129I	9.87E-01	240Pu	9.13E+01
134Cs	5.07E-01	241Pu	4.51E+02
137Cs	2.35E+05	242Pu	2.88E-03
137mBa	2.22E+05	241Am	1.04E+02
151Sm	1.31E+04	243Am	3.44E-03
152Eu	3.35E+00	242Cm	2.48E-01
154Eu	8.91E+01	243Cm	2.00E-02
155Eu	2.26E+01	244Cm	1.79E-01

## 11.0 PHYSICAL FORM

*Regulatory Citation: Indicate the physical form of each radionuclide in inventory: Solid, particulate solids, liquid, or gas.*

Radionuclides in the tank are in the form of liquids, saltcake, and sludge. Radionuclides in the soil and pits are expected to be particulates.

## 12.0 RELEASE FORM

*Regulatory Citation: Indicate the release form of each radionuclide in inventory: Particulate solids, vapor, or gas. Give the chemical form and ICRP 30 solubility class, if known.*

The radionuclides in the inventory listed in Table 1 all are assumed to be released as particulate except for H-3 and C-14. These are assumed to be released as a combination of particulates and gas. In addition, though Ru-106 and I-129 are assumed to be released as particulate, it is not assumed that the HEPA filters serve as effective abatement for these two radionuclides. Even so, emissions of these radionuclides are estimated to contribute less than 1% of the total. See Appendix D.

## 13.0 RELEASE RATES

*Regulatory Citation: Release rates. (a) New emission unit(s): Give predicted release rates without any emissions control equipment (the potential-to-emit) and with the proposed control equipment using the efficiencies described in subsection (6) of this section. (b) Modified emission unit(s): Give predicted release rates without any emissions control equipment (the potential-to-emit) and with the existing and proposed control equipment using the efficiencies described in subsection (6) of this section. Provide the latest year's emissions data or emissions estimates. In all cases, indicate whether the emission unit is operating in a batch or continuous mode.*

This emission unit will be operating in a continuous mode. The release rates from the pits, tank, and soil are based on the 40 CFR 61, Appendix D release factor for particulates ( $1\text{E-}03$ ). Abated emissions from the entire Hanford Site were reported in DOE/RL-2002-20, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2001*, as 0.49mrem.

### 13.1 PIT WORK PTE

The Annual Possession Quantity (APQ) for pit work was calculated at  $3.1\text{E-}02$  Curies. The onsite unabated and abated dose was calculated at  $3.5\text{E-}07$  mrem/year. The APQ for this activity is based on operating experience. The maximum removable concentrations used to calculate the emissions were 20 dpm/100  $\text{cm}^2$  alpha and  $1\text{E}+06$  dpm/100  $\text{cm}^2$  beta/gamma as representation of a worse case pit contamination. The total surface area of  $6.78\text{E}6$   $\text{cm}^2$  was calculated by multiplying the area of the largest individual pit ( $14'\times 12'\times 12'$ ) and the estimated number of entries into the pits (8). A conservative number was chosen for estimated entries. The onsite dose of  $1.9\text{E-}07$  was used because the summation of the doses of the activities described in this NOC resulted in a higher onsite dose. Release rate calculations for pit work are presented in Appendix A.

### 13.2 RISER WORK PTE

The calculated onsite unabated and abated emissions for equipment removal are  $5.4\text{E-}03$  mrem/year. The emissions calculations for the removal of equipment assumed a 0.063-inch uniformly distributed waste thickness across the surface area of the equipment. The total volume was found by multiplying the total surface area and the waste thickness. Equipment planned for removal includes, but is not limited to, a saltwell screen and pump and an LOW. The total surface area of the equipment was doubled to account for removal of other equipment. Release rate calculations for riser work are presented in Appendix B.

### 13.3 SOIL EXCAVATION PTE

The APQ for soil excavation was calculated at  $1.3\text{E-}02$  Curies. The onsite unabated and abated dose was calculated at  $2.1\text{E-}04$  mrem/year. The calculation used maximum readings of 20 cpm alpha and  $5\text{E}+02$  cpm beta/gamma. The maximum soil to be excavated is 1000  $\text{feet}^3$  with an average soil density of 98 pounds/ $\text{feet}^3$ . Release rate calculations for soil excavation are presented in Appendix C.

### 13.4 OPERATION PTE

During active ventilation, the portable exhauster will be operating. The emissions will consist of  $8.3\text{E}+01$  mrem/year unabated onsite and  $4.1\text{E-}02$  mrem/year abated onsite. Release rate calculations for active ventilation are presented in Appendix D.

During passive ventilation, the portable exhauster will be valved off and air will enter or exit the tank through the breather filters. The emissions will consist of 1.5E-05 mrem/year unabated onsite and 1.5E-07 mrem/year abated onsite. The calculations used an anticipated flow of 10 cubic feet per minute through the breather filter. Release rate calculations for passive ventilation are presented in Appendix E.

#### 14.0 LOCATION OF THE MAXIMALLY EXPOSED INDIVIDUAL

*Regulatory Citation: Identify the MEI by distance and direction from the emission unit(s). The MEI is determined by considering distance, windrose data, presence of vegetable gardens, and meat or milk producing animals at unrestricted areas surrounding the emission unit.*

The Maximally Exposed Individual (MEI) is determined using CAP-88 dispersion factors, which are derived for use on the Hanford Site and published in HNF-3602, Revision 1, *Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs*. Values used for 241-U-107 came from Table 4-10 (refer to HNF-3602, Rev. 1), for the 200 West Area, with effective release height <40 meters. Table 4-10 gives values in two separate columns for an Offsite Maximum Public Receptor (MPR) and an Onsite MPR. Values from both columns were used to determine the maximum dose. Their results indicated that the Onsite MPR received the maximum dose. For the 200 West Area, the maximum public receptor location is 18,310 meters east southeast of the 200 West areas, at the Laser Interferometer Gravitational Observatory.

#### 15.0 TOTAL EFFECTIVE DOSE EQUIVALENT TO THE MAXIMALLY EXPOSED INDIVIDUAL

*Calculate the TEDE to the MEI using an approved procedure (see WAC 246-247-085). For each radionuclide identified in subsection (8) of this section, determine the TEDE to the MEI for existing and proposed emission controls, and without any emission controls (the potential-to-emit) using the release rates from subsection (13) of this section. Provide all input data used in the calculations.*

The TEDE to the MEI resulted in a total estimated potential unabated onsite dose of approximately 83 mrem/yr as shown in Table 2. The abated emissions estimate onsite was 0.047 mrem/year.

Table 2: Emission Estimate Summation		
Activity	Unabated PTE	Abated Estimate
	Onsite MPR	Onsite MPR
Operation	8.3E+01	4.1E-02
Equipment	5.4E-03	5.4E-03
Pit	3.5E-07	3.5E-07
Passive	1.5E-05	1.5E-07
Soil	2.1E-04	2.1E-04
Total	8.3E+01	4.7E-02

## 16.0 COST FACTORS

*Provide cost factors for construction, operation, and maintenance of the proposed control technology components and system, if a BARCT or ALARACT demonstration is not submitted with the NOC.*

In accordance with WAC 246-247-110, Appendix A (16), cost factors for construction, operation, and maintenance of proposed control technology are not required, as the Washington Department of Health (WDOH) has provided guidance that HEPA filters generally are best available radionuclide control technology (BARCT) for particulate emissions. It is proposed that the HEPA filters be accepted as BARCT because the radionuclides of concern are particulates. It also is proposed that the passive breather filters, be approved ALARACT for saltcake dissolution and retrieval activities performed in the passive ventilation mode.

## 17.0 ESTIMATED DURATION OR LIFETIME

*Regulatory Citation: Provide an estimate of the lifetime for the facility process with the emission rates provided in this application.*

### 17.1 ESTIMATED DURATION OF PREPARATORY WORK

The expected duration of preparatory work is 6 months.

### 17.2 ESTIMATED DURATION OF OPERATIONS

The 241-U-107 Retrieval Project is expected to begin construction around January or February 2003 and conclude within the next 1-3 years.

The minimum design life of the portable exhauster equipment is 10 years. The exhauster may be operated continuously or intermittently for the duration of the pumping campaign. Pumping operations could be in a continuous mode for up to 6 months. Operations will be conducted up to 24 hours a day, 7 days a week.

## 18.0 STANDARDS

*Regulatory Citation: "Indicate which of the following control technology standards have been considered and will be complied with in the design and operation of the emission unit(s) described in this application: . . ."*

*ASME/ANSI AG-1, ASME/ANSI N509, ASME/ANSI N510, ANSI/ASME NQA-1, 40 CFR 60, Appendix A Methods 1, 1A, 2, 2A, 2C, 2D, 4, 5, and 17, and ANSI N13.1.*

### 18.1 PASSIVE VENTILATION

The breather filter (passive ventilation system) has been designed to meet the required WAC-246-247-110 control technology standards as described in Table 3.

Table 3. Breather Filter Standards Comparison.

Standard	Does design comply?	Notes
ASME/ANSI AG-1	Yes	Filters installed and G-1 housing design meet ASME AG-1.
ASME/ANSI N509	Yes	Filters installed and G-1 housing design meet ANSI N509.
ASME/ANSI N510	Yes	Filters are testable per ANSI N510.
ANSI/ASME NQA-1	Yes	Current version of QA program is RPP-MP-600.
ANSI N13.1	NA	Confirmatory measurements will consist of smears on the filter.
40 CFR 60, Appendix A Test Methods: 1, 1A, 2, 2A, 2C, 2D, 4	NA	ASME N510 filter testing requires airflow measurements. Other methods not required because flow rates vary based upon barometric breathing.
40 CFR 60, Appendix A Test Methods: 5, 17	NA	These methods are for sampling system designs. Periodic confirmatory measurements will be taken via smears in lieu of a sampling system.

## 18.2 ACTIVE VENTILATION

The portable exhaustor (active ventilation system) has been designed to meet the standards as follows:

### 18.2.1 Compliance for the 296-P-43 Exhauster

#### 18.2.1.1 AG-1

American Society for Engineers (ASME)/American National Standards Institute (ANSI) AG-1: This equipment specific code consists of five primary sections, which are applicable to this unit. The applicable sections are fans (Section BA), ductwork (Section SA), HEPA filter housing (Section HA), HEPA filters (Section FC), dampers (Section DA), heaters (Section CA) and Quality Assurance (QA) (Section AA).

The fan section of AG-1 (Section BA) covers the construction and testing requirements for fans. This fan meets the applicable criteria identified in AG-1, except as identified below. It was constructed to the Air Movement and Control Association (AMCA) 99-401, "Spark Resistant Construction," criteria, and was tested to the applicable sections of AMCA 210. However, it cannot be shown the shaft leakage criteria are met (Section BA 4142.2). This is acceptable because a shaft-packing box is installed around the shaft to minimize the leakage, and the leakage point is located after the HEPA filters.

The next applicable requirement is the ductwork section of AG-1 (Section SA). As was the case for the fan, this section identifies several requirements for ductwork. This includes acceptable material, fabrication, and testing criteria. The ductwork used will be a combination of both metal and flexible polymer. In both cases it does meet the applicable criteria and will be pressure tested per the applicable criteria identified in AG-1 and N510 prior to operation.

The HEPA filter housing section (Section HA) was recently released and this section has taken the place of the requirements identified in N509. After reviewing the requirements identified in Section HA against the portable exhauster design, the portable exhauster filter housings are in compliance.

The HEPA filter section of AG-1 (Section FC) is also applicable in this instance. The filters, which will be installed in the exhauster, will meet the applicable sections of AG-1, except for two areas dealing with filter qualification testing. Justification for this exception was discussed with and approved by WDOH at the December 1998 Routine Technical Assistance Meeting.

The dampers installed on the portable exhauster do meet the applicable AG-1 criteria, Section DA. This includes design, construction and testing. The manufacturer performed a leak test on the valves, and a pressure decay test was also completed on the exhaust train system. For the pressure decay test, the valves were used for isolation. The test was successful.

The heater installed in the portable exhauster meets the requirements of AG-1, Section CA. The heater relies on a glycol mixture that is heated by a separate heating unit, similar to a hot water tank. The heated glycol is then pumped through the heating coil located inside the exhaust system. This type of design allows the system to be used in a flammable gas environment. By using a glycol heater, there are no electrical, sparking or energized components in contact with the air stream. In addition, controls are in place to prevent the damage of the HEPA filters if the coil were to fail. This includes level detection in the glycol reservoir, which will detect the loss of glycol. Differential pressure across the first HEPA filter is monitored. If the coil were to break, the differential pressure across the first HEPA would increase and the system would be shutdown.

The quality assurance section of AG-1 relies on ASME NQA-1. The general QA criteria are located in Section AA. Specific component/system criteria are located in each section throughout AG-1. The portable exhauster was built on the Hanford Site and meets the site's QA program. This includes procurement of the safety material/components, along with appropriate pedigree from an evaluated supplier, tracking and maintaining the material/components after it arrived on site, inspection of the material/components, and witnessing the testing. Based on the above, the AG-1 criteria are met.

#### **18.2.1.2 ASME N509**

This standard deals with the individual components and how they relate to the overall system. The major sections of ASME/ANSI N509 have been replaced with those identified in AG-1. There are certain sections that are still applicable, such as Section 4.3, which discusses the maximum flow rate for the system not to exceed the lowest maximum rating of any component installed in the system. This is being met, along with the other applicable sections of N509.

#### **18.2.1.3 ASME N510**

This standard pertains to the testing of nuclear air cleaning systems. The first requirement identified in ASME/ANSI N510 is to perform a pressure decay test. This is to assure there are no infiltration or outward leak paths from the system. This test was completed on the portable exhauster and was successful.

This system meets the leak test criteria identified per N510. Test sections are located in the exhaust train to allow for proper independent testing of both HEPA filters.

#### **18.2.1.4 ANSI/ASME NQA-1**

The required technology standard is ANSI/ASME NQA-1, Quality Assurance Program requirements for Nuclear Facilities. Quality Assurance for the ventilation system will be performed in accordance with the current revision of RPP-MP-600, Quality Assurance Program Description.

#### **18.2.1.5 Stack Volumetric Flow Rate Determination Methods**

Stack effluent flow rates are necessary to compile emissions and complete the required annual reports. Requirements for flow rates can be broken into three areas of discussion:

1. Measurements Location: The regulatory methods that specify the measurement location, distances from flow disturbances, number of measurements to take, etc. are provided in the following two methods:
  - 40 CFR 60, Appendix A, Methods 1 – Sample and Velocity Traverses for Stationary Sources.
  - 40 CFR 60, Appendix A, Methods 1A - Sample and Velocity Traverses for Stationary Sources with Small Stacks or Ducts.

The difference in these two methods is that one is for stacks 12 inches in diameter and larger, and the other is for under 12 inches. The exhauster stack is smaller than 12 inches. Therefore, Method 1A is followed for this exhauster.

2. Measurement Method: The regulatory method that specify the measurement method and instrumentation to use are as follows:
  - 40 CFR 60, Appendix A, Methods 2 – Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube).
  - 40 CFR 60, Appendix A, Methods 2A – Direct Measurement of Gas Volume Through Pipes and Small Ducts
  - 40 CFR 60, Appendix A, Methods 2C – Determination of Gas Velocity and Volumetric Flow Rate in Small Stacks or Ducts (Standard Pitot Tube). This method is applicable for the determination of average velocity and volumetric flow rate of gas streams in small stacks or ducts.

- 40 CFR 60, Appendix A, Methods 2D – Measurement of Gas Volume Flow Rates in Small Pipes and Ducts.

Either Method 2 or Method 2C are used in Tank Farms. The primary difference between Method 2 and 2C lies in the fact that Method 2 is applicable for stacks larger than 12 inches in diameter, while 2C applies to stack smaller than 12 inches. Method 2C is followed for this exhauster.

3. Measurement Result: Flow rates are to be reported in dry standard units of temperature and pressure. This means that the moisture content of the air stream must be taken into account when finalizing the flow rate values. Method 2 and Method 2C (through reference to Method 2) call the following method for this determination:
  - 40 CFR 60, Appendix A, Methods 4 – Determination of Moisture Content in Stack Gases. This method is applicable to determination of moisture content in stack gas. This method is called out for use in Method 2 and 2C (through call out of Method 2). Method 2 requires that flow rates be converted to dry standard units.

This method is not used. Instead a humidity probe is used to determine moisture content of the stream. The humidity value determined from this instrument is mathematically incorporated into the final flow rate measurement.

In addition to the methods just discussed; 40 CFR 52, Appendix E – Performance Specifications and, Specification Test Procedures for Monitoring Systems for Effluent Stream Gas Volumetric Flow Rate – is also used. The methods discussed above are for manual measurements. The Appendix E method allows for the installation and operation of instrumentation to automatically and continuously take flow rate measurements. The Appendix E method requires use of Method 2 for use in comparison of the instrumentation readings and if after a series of measurements are taken the instrument accuracy is determined to be within that specified by the Appendix E method, the instrumentation is considered acceptable and can be used for flow rate determination and emission reporting purposes.

The exhauster has been tested to Appendix E.

#### **18.2.1.6 Sampling System Design Methods and Standards**

Methods and Standards called out for sampling system design are as follows:

- 40 CFR 60, Appendix A, Methods 5 – Determination of Particulate Matter Emissions from Stationary Sources. This method is applicable for the determination of particulate emissions. This method details the sample probe, collection filter and holder, the vacuum system and instrumentation that might be used in the design of a particulate sample collection system.
- 40 CFR 60, Appendix A, “Methods 17 – Determination of Particulate Matter Emissions from Stationary Sources.” This method is applicable for determination of particulate matter (PM) emissions, where PM concentrations are known to be independent of temperature over the normal range of temperatures characteristic of emissions from a specified source category. It is intended for use only when specified by an applicable subpart of the standards, and only within the applicable temperature limits (if specified),

or when otherwise approved by the Administrator. There are other provisions for use of this method. This method details the sample probe, collection filter and holder, the vacuum system and instrumentation that might be used in the design of a particulate sample collection system.

- ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities
- ANSI/HPS N13.1-1999, sampling and Monitoring Releases of Airborne Radioactive Substances from Stacks and Ducts of Nuclear Facilities:

No attempts have been made to design the sampling and monitoring system to Methods 5 and 17. Instead, the system has been designed to meet the intent of ANSI/HPS N13.1-1999. A shrouded probe assembly is installed. The installation location, as well as the shrouded probe assembly, to include transport lines, has been qualified per the applicable requirements of ANSI/HPS N13.1-1999. This is documented in PNNL-11701, *Generic Effluent Monitoring System Certification for Salt Well Portable Exhauster*.

#### **18.2.2 Compliance for the 296-P-43 Exhauster**

The 296-P-34 ventilation system was being designed to meet the required WAC-246-247-110 control technology standards as described below.

##### **18.2.2.1 Abatement Technology Standards**

The abatement technology for the new 296-P-34 ventilation system is designed to meet the cited codes and standards as follows:

The system ductwork meets the requirements of ASME N509

The HEPA filters meet the applicable performance, design, construction, acceptance testing, and quality assurance requirements in ASME AG-1a, Section FC.

The filter housings and housing supports meet the applicable design performance, fabrication, inspection, acceptance testing, and quality assurance requirements of ASME N509.

##### **18.2.2.2 Quality Assurance for the Ventilation System**

Quality assurance is the same as for the 296-P-43 exhauster.

##### **18.2.2.3 Stack Volumetric Flow Rate Determination Methods for the Ventilation System**

The 296-P-34 stack is a 4-inch section where a radionuclide particulate sampling probe is installed. Flow measurements are taken from two ports located 90 degree apart, between the sampling probe and the fan. The 296-P-34 stack flow measurement is taken via a procedure written, patterned after Method 2C. A standard pitot tube will be used. A humidity probe is used to determine moisture content of the stream. The humidity value determined from this instrument is mathematically incorporated into the final flow rate measurement. In addition, the 296-P-34 Ventilation system was tested to Appendix E.

#### 18.2.2.4 Sampling System Design Methods and Standards

The system was been designed to meet the intent of ANSI N13.1-1969.

### 19.0 REFERENCES

40 CFR 60, "Standards for Performance of New Stationary Sources," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutant," *Code of Federal Regulations*, as amended.

40 CFR 52, "Approval and Promulgation of Implementation Plans," *Code of Federal Regulations*, as amended.

AMCA Standard 99-0401-86, Air Movement Contractors Association, Chicago, Illinois

ANSI/ASME AG-1, 1997, *Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers, New York, New York.

ANSI/ASME NQA-1, *Quality Assurance program Requirements for Nuclear Facilities*, American Society of Mechanical Engineers, New York, New York.

ANSI/HPS N13.1, 1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from Stacks and Ducts of Nuclear Facilities*, American National Standards Institute, New York, New York.

ANSI N13.1, 1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, American National Standards Institute, New York, New York.

ANSI N509, *Nuclear Power Plant Air Cleaning Units and Components*, American National Standards Institute, New York, New York.

ANSI N510, *Testing of Nuclear Air Treatment Systems*, American National Standards Institute, New York, New York.

DOE/RL 97-09, *Radioactive Air Emissions Notice of Construction Use of a Portable Exhauster on Single-Shell Tanks During Salt Well Pumping*, U. S. Department of Energy, Richland, Washington.

DOE/RL-2002-20, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2001*, U. S. Department of Energy, Richland, Washington.

HNF-0528, Revision 4, *National Emission Standards for Hazardous Air Pollutants (NESHAP) Quality Assurance Project Plan for Radioactive Airborne Emissions*, Fluor Hanford Group, Inc., Richland Washington

- HNF-3602, Revision 1, 2002, *Calculating Potential-to-Emit Release and Dose for FEMP and NOCs*, Fluor Hanford Group Inc., Richland, Washington.
- HNF-4327, Revision 1A, 2002, *Control of Airborne Radioactive Emissions for Frequently Performed TWRS Work Activities (ALARACT Demonstrations)*, CH2MHILL Hanford Group, Inc., Richland, Washington.
- HNF-5183, Revision 0, July 2000, *Tank Farms Radiological Control Manual*, CH2M HILL Hanford Group, Inc., Richland, Washington.
- HNF-SD-WM-TI-797, Revision 3, September 1998, *Results of Vapor Space Monitoring of Flammable Gas Watch List Tanks*, Fluor Hanford Group, Inc., Richland, Washington.
- PNNL-11701 UC-702, 1997, *Generic Effluent Monitoring System Certification for Salt Well Portable Exhauster*, Pacific Northwest National Laboratory, Richland, Washington.
- RPP-QAPP-003, 1999, *CHG Double Shell Tanks and Waste Feed Delivery Project Program Plan*, CH2M HILL Hanford Group, Inc., Richland, Washington.
- RPP-QAPP-004, 2001, *CHG Quality Assurance Program Plan For Tank Farm Contractor Radioactive Air Emissions*, CH2M HILL Hanford Group, Inc., Richland, Washington.
- WAC 197-11-845, *State Environmental Policy Act*, "SEPA Rules, Department of Social and Health Services," *Washington Administration Code*, as amended.
- WAC 246-247, "Radiation Protection – Air Emissions," *Washington Administrative Code*, as amended.

**APPENDIX A**  
**PIT WORK PTE FOR 241-U-107 RETRIEVAL PROJECT**

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Appendix A. Pit Work PTE for 241-U-107 Retrieval Project										
Release Fraction	Area of Individual Pit		Total Surface Area of Pits	Multiplier (estimated entries)	Pit Size					
RF	S		TSA = S*M	M	14'x12'x12'					
1.00E-03	cm <sup>2</sup>	ft <sup>2</sup>	cm <sup>2</sup>							
	8.47E+05	9.12E+02	6.78E+06	8						
Smear Sample Calculations	Max Smear Removable Concentration	Conversion (dpm/100cm <sup>2</sup> ) to (Ci/cm <sup>2</sup> )	Max Smear Concentration	Possession Quantity	Unabated & Abated Release	200 West CAP-88 Dose Factor		Unabated & Abated Dose		
						Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR	
	dpm/100 cm <sup>2</sup>	Ci/cm <sup>2</sup>	Ci/cm <sup>2</sup>	Ci	Ci/yr	mrem/Ci		mrem/yr		%
Equations	A	B	C = A*B	D = (TSA)*C	E = RF*D	F	G	H=E*F	I=E*G	J=H/SumH
Alpha (Am-241)	20	4.5E-15	9.0E-14	6.1E-07	6.1E-10	9.8E+00	1.7E+01	6.0E-09	1.0E-02	0.2%
Beta (Sr-90)	1,000,000	4.5E-15	4.5E-09	3.1E-02	3.1E-05	8.8E-02	1.1E-02	2.7E-06	3.4E-07	99.8%
							Totals	2.7E-06	3.5E-07	

**Notes:**

HNF-3602, Rev 1, Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs. The Offsite Dose Factor is an annual quantity.

**APPENDIX B**  
**RISER WORK PTE FOR 241-U-107 RETRIEVAL PROJECT**

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Appendix B. Equipment Removal PTE for 241-U-107 Retrieval Project										
Analyte	U-107 Inventory		Inventory on Equipment	Release Fraction	U-107 Emissions	CAP-88 Dose Conversion Factors for 200 West Area		Abated and Unabated Emissions		
						Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR	
	CI	CI/gal*	CI**		CI	mrem/CI ***		mrem/yr		%
Equations	A	B=A/408,000	C=B*27	D	E=C*D	F	G	H=E*F	I=E*G	J=I/SumI
3H	3.00E+02	7.35E-04	1.97E-02	1.0E-03	2.0E-05	2.5E-05	1.1E-05	4.9E-10	2.2E-10	0.0%
14C	6.01E+01	1.47E-04	3.94E-03	1.0E-03	3.9E-06	2.0E-03	3.0E-04	7.9E-09	1.2E-09	0.0%
60Co	1.23E+00	3.01E-06	8.07E-05	1.0E-03	8.1E-08	1.9E-01	3.4E-01	1.5E-08	2.7E-08	0.0%
59Ni	1.59E+01	3.90E-05	1.04E-03	1.0E-03	1.0E-06	2.4E-04	3.3E-04	2.5E-10	3.4E-10	0.0%
63Ni	1.15E+02	2.82E-04	7.55E-03	1.0E-03	7.5E-06	2.0E-04	7.8E-05	1.5E-09	5.9E-10	0.0%
79Se	3.92E-01	9.61E-07	2.57E-05	1.0E-03	2.6E-08	1.0E-01	1.6E-01	2.6E-09	4.1E-09	0.0%
90Sr	5.47E+03	1.34E-02	3.59E-01	1.0E-03	3.6E-04	8.8E-02	1.1E-02	3.2E-05	3.9E-06	0.1%
90Y	5.47E+03	1.34E-02	3.59E-01	1.0E-03	3.6E-04	2.6E-04	2.9E-04	9.3E-08	1.0E-07	0.0%
93Zr	1.93E+01	4.73E-05	1.27E-03	1.0E-03	1.3E-06	9.9E-04	1.5E-03	1.3E-09	1.9E-09	0.0%
93mNb	1.56E+01	3.82E-05	1.02E-03	1.0E-03	1.0E-06	1.6E-03	1.3E-03	1.6E-09	1.3E-09	0.0%
99Tc	5.10E+02	1.25E-03	3.35E-02	1.0E-03	3.3E-05	1.8E-02	1.8E-03	6.0E-07	6.0E-08	0.0%
106Ru	6.00E-05	1.47E-10	3.94E-09	1.0E-03	3.9E-12	1.2E-02	1.5E-02	4.7E-14	5.9E-14	0.0%
113mCd	7.15E+01	1.75E-04	4.69E-03	1.0E-03	4.7E-06	1.0E-01	1.6E-01	4.7E-07	7.5E-07	0.0%
126Sn	2.37E+00	5.81E-06	1.56E-04	1.0E-03	1.6E-07	3.7E-02	4.6E-02	5.8E-09	7.2E-09	0.0%
125Sb	3.35E+01	8.21E-05	2.20E-03	1.0E-03	2.2E-06	2.1E-02	3.7E-02	4.6E-08	8.1E-08	0.0%
129I	9.87E-01	2.42E-06	6.48E-05	1.0E-03	6.5E-08	7.6E-02	8.1E-03	4.9E-09	5.2E-10	0.0%
134Cs	5.07E-01	1.24E-06	3.33E-05	1.0E-03	3.3E-08	7.8E-02	1.0E-01	2.6E-09	3.3E-09	0.0%
137Cs	2.35E+05	5.76E-01	1.54E+01	1.0E-03	1.5E-02	1.9E-01	3.1E-01	2.9E-03	4.8E-03	87.9%
137mBa	2.22E+05	5.44E-01	1.46E+01	1.0E-03	1.5E-02	8.6E-14	1.7E-12	1.3E-15	2.5E-14	0.0%
151Sm	1.31E+04	3.21E-02	8.60E-01	1.0E-03	8.6E-04	5.8E-04	9.5E-04	5.0E-07	8.2E-07	0.0%
152Eu	3.35E+00	8.21E-06	2.20E-04	1.0E-03	2.2E-07	1.9E-01	3.4E-01	4.2E-08	7.5E-08	0.0%
154Eu	8.91E+01	2.18E-04	5.85E-03	1.0E-03	5.8E-06	1.5E-01	2.8E-01	8.8E-07	1.6E-06	0.0%
155Eu	2.26E+01	5.54E-05	1.48E-03	1.0E-03	1.5E-06	6.3E-03	1.1E-02	9.3E-09	1.6E-08	0.0%
226Ra	1.76E-04	4.31E-10	1.15E-08	1.0E-03	1.2E-11	3.6E-01	2.9E-01	4.2E-12	3.3E-12	0.0%
228Ra	6.61E-02	1.62E-07	4.34E-06	1.0E-03	4.3E-09	1.5E-01	7.9E-02	6.5E-10	3.4E-10	0.0%
227Ac	1.83E-03	4.49E-09	1.20E-07	1.0E-03	1.2E-10	1.1E+01	2.0E+01	1.3E-09	2.4E-09	0.0%
229Th	2.97E-03	7.28E-09	1.95E-07	1.0E-03	1.9E-10	1.2E+01	2.2E+01	2.3E-09	4.3E-09	0.0%

Appendix B. Equipment Removal PTE for 241-U-107 Retrieval Project										
Analyte	U-107 Inventory		Inventory on Equipment	Release Fraction	U-107 Emissions	CAP-88 Dose Conversion Factors for 200 West Area		Abated and Unabated Emissions		
						Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR	
	Ci	Ci/gal*	Ci**		Ci	mrem/Ci ***		mrem/yr		%
Equations	A	B=A/408,000	C=B*27	D	E=C*D	F	G	H=E*F	I=E*G	J=I/SumI
232Th	1.34E-02	3.28E-08	8.79E-07	1.0E-03	8.8E-10	6.2E+00	1.1E+01	5.5E-09	9.7E-09	0.0%
231Pa	4.84E-03	1.19E-08	3.18E-07	1.0E-03	3.2E-10	8.9E+00	1.5E+01	2.8E-09	4.8E-09	0.0%
232U	3.29E-02	8.06E-08	2.16E-06	1.0E-03	2.2E-09	8.6E+00	1.5E+01	1.9E-08	3.2E-08	0.0%
233U	1.35E-01	3.31E-07	8.86E-06	1.0E-03	8.9E-09	2.4E+00	4.2E+00	2.1E-08	3.7E-08	0.0%
234U	3.30E-01	8.09E-07	2.17E-05	1.0E-03	2.2E-08	2.4E+00	4.2E+00	5.2E-08	9.1E-08	0.0%
235U	1.40E-02	3.43E-08	9.19E-07	1.0E-03	9.2E-10	2.3E+00	4.0E+00	2.1E-09	3.7E-09	0.0%
236U	7.63E-03	1.87E-08	5.01E-07	1.0E-03	5.0E-10	2.3E+00	3.9E+00	1.2E-09	2.0E-09	0.0%
238U	3.19E-01	7.82E-07	2.09E-05	1.0E-03	2.1E-08	2.1E+00	3.7E+00	4.4E-08	7.7E-08	0.0%
237Np	1.87E+00	4.58E-06	1.23E-04	1.0E-03	1.2E-07	8.9E+00	1.6E+01	1.1E-06	2.0E-06	0.0%
238Pu	1.03E+01	2.52E-05	6.76E-04	1.0E-03	6.8E-07	5.9E+00	1.0E+01	4.0E-06	6.8E-06	0.1%
239Pu	6.31E+02	1.55E-03	4.14E-02	1.0E-03	4.1E-05	6.4E+00	1.1E+01	2.7E-04	4.6E-04	8.4%
240Pu	9.13E+01	2.24E-04	5.99E-03	1.0E-03	6.0E-06	6.4E+00	1.1E+01	3.8E-05	6.6E-05	1.2%
241Pu	4.51E+02	1.11E-03	2.96E-02	1.0E-03	3.0E-05	1.0E+01	1.6E+01	3.0E-06	4.7E-06	0.1%
242Pu	2.88E-03	7.06E-09	1.89E-07	1.0E-03	1.9E-10	6.1E+00	1.0E+01	1.2E-09	1.9E-09	0.0%
241Am	1.04E+02	2.55E-04	6.82E-03	1.0E-03	6.8E-06	9.8E+00	1.7E+01	6.7E-05	1.2E-04	2.1%
243Am	3.44E-03	8.43E-09	2.26E-07	1.0E-03	2.3E-10	9.8E+00	1.7E+01	2.2E-09	3.8E-09	0.0%
242Cm	2.48E-01	6.08E-07	1.63E-05	1.0E-03	1.6E-08	3.2E+01	5.7E+01	5.2E-09	9.3E-09	0.0%
243Cm	2.00E-02	4.90E-08	1.31E-06	1.0E-03	1.3E-09	6.6E+00	1.2E+01	8.7E-09	1.6E-08	0.0%
244Cm	1.79E-01	4.39E-07	1.17E-05	1.0E-03	1.2E-08	5.2E+00	9.0E+00	6.1E-08	1.1E-07	0.0%
TOTALS								3.3E-03	5.4E-03	

Note:

- \*The quantity of waste contained in the tank according to HNF-EP-0182, Rev. 157, was 408,000 gallons.
- \*\* The quantity of waste estimated to be contained on the equipment to be removed is 27 gallons — see Section 13.2
- \*\*\* Dose conversion factors are from HNF-3602, Rev 1, *Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs* January 2002

**APPENDIX C**  
**SOIL EXCAVATION PTE FOR 241-U-107 RETRIEVAL PROJECT**

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Appendix C. Soil Excavation PTE for 241-U-107 Retrieval Project								
Maximum Soil Excavated	Soil Density	Total Mass of Soil	Maximum Alpha Reading	Maximum Beta/Gamma Reading		Release Fraction		
		A	B	C		D		
feet^3	pounds/feet^3	grams	cpm	cpm	dpm/probe*			
1,000	98	4.45E+07	20	500	5,000	1.0E-03		
Assumed Isotope	Conversion Factor <sup>1</sup>	Possession Quantity <sup>2</sup>	Estimated Release	CAP-88 Dose Conversion Factors for 200 West Area <sup>3</sup>		Unabated & Abated Dose		
				Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR	
	(pCi/gram)/cpm	Ci	Ci	mrem/Ci		mrem/yr		%
Equations	E	F=A*B*E/1E+12 or A*C*E/1E+12	G=F*D	H	I	J=G*H	K=G*I	L=K/Sum K
Sr-90	0.35	7.9E-03	7.9E-06	8.8E-02	1.1E-02	6.9E-07	8.7E-08	0.04%
Am-241	14.20	1.3E-02	1.3E-05	9.8E+00	1.7E+01	1.2E-04	2.1E-04	99.96%
					Totals	1.2E-04	2.1E-04	

**Notes:**

- 1 HNF-2418, Soil Contamination Standards for Protection of Personnel, March 1998, P.D. Rittmann Tables 1 and 4 based on 500 mrem/yr.
- 2 MASS OF SOIL X FIELD INSTRUMENT READING X CONVERSION FACTOR.
- 3 HNF-3602, Rev 1, Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs. The Offsite Dose Factor is an annual quantity.
- \* Source RSR # 1500334 (7-24-01)

**APPENDIX D**  
**OPERATION PTE FOR 241-U-107 RETRIEVAL PROJECT ACTIVE VENTILATION**

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**Appendix D. Active Ventilation Operation PTE for 241-U-107 Retrieval Project**

Analyte	U-107 Inventory	Release Fraction	Estimated Emissions	CAP-88 Dose Conversion Factors for 200 West Area <sup>1</sup>		Estimated Unabated Dose			Abatement Factor	Estimated Abated Emissions			
				Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR			Onsite MPR			
							mrem/Ci	mrem/yr		mrem/yr	%	mrem/yr	%
Equations	A	B	C=A*B	D	E	F=C*D	G=C*E	H=G/SumG	I	J=H*I	K=J/SumJ		
3H	3.00E+02	1.0E-03	3.0E-01	2.5E-05	1.1E-05	7.5E-06	3.3E-06	0.0%	100%	3.3E-06	0.0%		
14C	6.01E+01	1.0E-03	6.0E-02	2.0E-03	3.0E-04	1.2E-04	1.8E-05	0.0%	100%	1.8E-05	0.0%		
60Co	1.23E+00	1.0E-03	1.2E-03	1.9E-01	3.4E-01	2.3E-04	4.2E-04	0.0%	0.05%	2.1E-07	0.0%		
59Ni	1.59E+01	1.0E-03	1.6E-02	2.4E-04	3.3E-04	3.8E-06	5.2E-06	0.0%	0.05%	2.6E-09	0.0%		
63Ni	1.15E+02	1.0E-03	1.2E-01	2.0E-04	7.8E-05	2.3E-05	9.0E-06	0.0%	0.05%	4.5E-09	0.0%		
79Se	3.92E-01	1.0E-03	3.9E-04	1.0E-01	1.6E-01	3.9E-05	6.3E-05	0.0%	0.05%	3.1E-08	0.0%		
90Sr	5.47E+03	1.0E-03	5.5E+00	8.8E-02	1.1E-02	4.8E-01	6.0E-02	0.1%	0.05%	3.0E-05	0.1%		
90Y	5.47E+03	1.0E-03	5.5E+00	2.6E-04	2.9E-04	1.4E-03	1.6E-03	0.0%	0.05%	7.9E-07	0.0%		
93Zr	1.93E+01	1.0E-03	1.9E-02	9.9E-04	1.5E-03	1.9E-05	2.9E-05	0.0%	0.05%	1.4E-08	0.0%		
93mNb	1.56E+01	1.0E-03	1.6E-02	1.6E-03	1.3E-03	2.5E-05	2.0E-05	0.0%	0.05%	1.0E-08	0.0%		
99Tc	5.10E+02	1.0E-03	5.1E-01	1.8E-02	1.8E-03	9.2E-03	9.2E-04	0.0%	0.05%	4.6E-07	0.0%		
106Ru	6.00E-05	1.0E-03	6.0E-08	1.2E-02	1.5E-02	7.2E-10	9.0E-10	0.0%	100%	9.0E-10	0.0%		
113mCd	7.15E+01	1.0E-03	7.2E-02	1.0E-01	1.6E-01	7.2E-03	1.1E-02	0.0%	0.05%	5.7E-06	0.0%		
126Sn	2.37E+00	1.0E-03	2.4E-03	3.7E-02	4.6E-02	8.8E-05	1.1E-04	0.0%	0.05%	5.5E-08	0.0%		
125Sb	3.35E+01	1.0E-03	3.4E-02	2.1E-02	3.7E-02	7.0E-04	1.2E-03	0.0%	0.05%	6.2E-07	0.0%		
129I	9.87E-01	1.0E-03	9.9E-04	7.6E-02	8.1E-03	7.5E-05	8.0E-06	0.0%	100%	8.0E-06	0.0%		
134Cs	5.07E-01	1.0E-03	5.1E-04	7.8E-02	1.0E-01	4.0E-05	5.1E-05	0.0%	0.05%	2.5E-08	0.0%		
137Cs	2.35E+05	1.0E-03	2.4E+02	1.9E-01	3.1E-01	4.5E+01	7.3E+01	87.9%	0.05%	3.6E-02	87.8%		
137mBa	2.22E+05	1.0E-03	2.2E+02	8.6E-14	1.7E-12	1.9E-11	3.8E-10	0.0%	0.05%	1.9E-13	0.0%		
151Sm	1.31E+04	1.0E-03	1.3E+01	5.8E-04	9.5E-04	7.6E-03	1.2E-02	0.0%	0.05%	6.2E-06	0.0%		
152Eu	3.35E+00	1.0E-03	3.4E-03	1.9E-01	3.4E-01	6.4E-04	1.1E-03	0.0%	0.05%	5.7E-07	0.0%		
154Eu	8.91E+01	1.0E-03	8.9E-02	1.5E-01	2.8E-01	1.3E-02	2.5E-02	0.0%	0.05%	1.2E-05	0.0%		
155Eu	2.26E+01	1.0E-03	2.3E-02	6.3E-03	1.1E-02	1.4E-04	2.5E-04	0.0%	0.05%	1.2E-07	0.0%		
226Ra	1.76E-04	1.0E-03	1.8E-07	3.6E-01	2.9E-01	6.3E-08	5.1E-08	0.0%	0.05%	2.6E-11	0.0%		
228Ra	6.61E-02	1.0E-03	6.6E-05	1.5E-01	7.9E-02	9.9E-06	5.2E-06	0.0%	0.05%	2.6E-09	0.0%		
227Ac	1.83E-03	1.0E-03	1.8E-06	1.1E+01	2.0E+01	2.0E-05	3.7E-05	0.0%	0.05%	1.8E-08	0.0%		

**Appendix D. Active Ventilation Operation PTE for 241-U-107 Retrieval Project**

Analyte	U-107 Inventory	Release Fraction	Estimated Emissions	CAP-88 Dose Conversion Factors for 200 West Area <sup>1</sup>		Estimated Unabated Dose			Abatement Factor	Estimated Abated Emissions	
Equations		B		Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR		I	Onsite MPR	
	Ci		Ci	mrem/Ci		mrem/yr	mrem/yr	%		mrem/yr	%
	A		C=A*B	D	E	F=C*D	G=C*E	H=G/SumG		J=H*I	K=J/SumJ
229Th	2.97E-03	1.0E-03	3.0E-06	1.2E+01	2.2E+01	3.6E-05	6.5E-05	0.0%	0.05%	3.3E-08	0.0%
232Th	1.34E-02	1.0E-03	1.3E-05	6.2E+00	1.1E+01	8.3E-05	1.5E-04	0.0%	0.05%	7.4E-08	0.0%
231Pa	4.84E-03	1.0E-03	4.8E-06	8.9E+00	1.5E+01	4.3E-05	7.3E-05	0.0%	0.05%	3.6E-08	0.0%
232U	3.29E-02	1.0E-03	3.3E-05	8.6E+00	1.5E+01	2.8E-04	4.9E-04	0.0%	0.05%	2.5E-07	0.0%
233U	1.35E-01	1.0E-03	1.4E-04	2.4E+00	4.2E+00	3.2E-04	5.7E-04	0.0%	0.05%	2.8E-07	0.0%
234U	3.30E-01	1.0E-03	3.3E-04	2.4E+00	4.2E+00	7.9E-04	1.4E-03	0.0%	0.05%	6.9E-07	0.0%
235U	1.40E-02	1.0E-03	1.4E-05	2.3E+00	4.0E+00	3.2E-05	5.6E-05	0.0%	0.05%	2.8E-08	0.0%
236U	7.63E-03	1.0E-03	7.6E-06	2.3E+00	3.9E+00	1.8E-05	3.0E-05	0.0%	0.05%	1.5E-08	0.0%
238U	3.19E-01	1.0E-03	3.2E-04	2.1E+00	3.7E+00	6.7E-04	1.2E-03	0.0%	0.05%	5.9E-07	0.0%
237Np	1.87E+00	1.0E-03	1.9E-03	8.9E+00	1.6E+01	1.7E-02	3.0E-02	0.0%	0.05%	1.5E-05	0.0%
238Pu	1.03E+01	1.0E-03	1.0E-02	5.9E+00	1.0E+01	6.1E-02	1.0E-01	0.1%	0.05%	5.2E-05	0.1%
239Pu	6.31E+02	1.0E-03	6.3E-01	6.4E+00	1.1E+01	4.0E+00	6.9E+00	8.4%	0.05%	3.5E-03	8.4%
240Pu	9.13E+01	1.0E-03	9.1E-02	6.4E+00	1.1E+01	5.8E-01	1.0E+00	1.2%	0.05%	5.0E-04	1.2%
241Pu	4.51E+02	1.0E-03	4.5E-01	1.0E-01	1.6E-01	4.5E-02	7.2E-02	0.1%	0.05%	3.6E-05	0.1%
242Pu	2.88E-03	1.0E-03	2.9E-06	6.1E+00	1.0E+01	1.8E-05	2.9E-05	0.0%	0.05%	1.4E-08	0.0%
241Am	1.04E+02	1.0E-03	1.0E-01	9.8E+00	1.7E+01	1.0E+00	1.8E+00	2.1%	0.05%	8.8E-04	2.1%
243Am	3.44E-03	1.0E-03	3.4E-06	9.8E+00	1.7E+01	3.4E-05	5.8E-05	0.0%	0.05%	2.9E-08	0.0%
242Cm	2.48E-01	1.0E-03	2.5E-04	3.2E-01	5.7E-01	7.9E-05	1.4E-04	0.0%	0.05%	7.1E-08	0.0%
243Cm	2.00E-02	1.0E-03	2.0E-05	6.6E+00	1.2E+01	1.3E-04	2.4E-04	0.0%	0.05%	1.2E-07	0.0%
244Cm	1.79E-01	1.0E-03	1.8E-04	5.2E+00	9.0E+00	9.3E-04	1.6E-03	0.0%	0.05%	8.1E-07	0.0%
					Totals	5.1E+01	8.3E+01			4.1E-02	

Notes:

1) Dose conversion factors are from HNF-3602, Rev 1, *Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs* January 2002

**APPENDIX E**  
**OPERATIONS PTE FOR 241-U-107 RETREIVAL PROJECT PASSIVE VENTILATION**

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Appendix E: Passive Ventilation PTE for 241-U-107 Retrieval Project											
	Vapor Concentration <sup>1</sup>			Emissions at 10 cfm <sup>3</sup>	Emissions at 10 cfm for a year	200 West CAP-88 Dose Factor <sup>2</sup>		Unabated Dose		Abated Dose	Unabated Dose
						Offsite MPR	Onsite MPR	Offsite MPR	Onsite MPR		
	pCi/L	Ci/m <sup>3</sup>	Ci/ft <sup>3</sup>	Ci/min	Ci	mrem/Ci		mrem/yr			%
<i>Equations</i>	A	B=A*1E-09	C=B*0.028	D=C*10	E=D*525600	F	G	H=E*F	I=E*G	J=I*0.01	K=I/SumI
Alpha (Am-241)	4.0E-03	4.0E-12	1.1E-13	1.1E-12	6.0E-07	9.8E+00	1.7E+01	5.8E-06	1.0E-05	1.0E-07	68.23%
Beta (Sr-90)	6.0E-02	6.0E-11	1.7E-12	1.7E-11	8.9E-06	8.8E-02	1.1E-02	7.9E-07	9.8E-08	9.8E-10	0.66%
Gamma (Cs-137)	1.0E-01	1.0E-10	2.8E-12	2.8E-11	1.5E-05	1.9E-01	3.1E-01	2.8E-06	4.6E-06	4.6E-08	31.11%
						<b>Totals</b>		<b>9.4E-06</b>	<b>1.5E-05</b>	<b>1.5E-07</b>	

Notes:

- 1) Vapor space data updated for 23 SST per PNNL Letter D. Sklarew (PNL) to G. Wells, CH2M HILL, August 27,2001
- 2) Dose conversion factors are from HNF-3602, Rev 1, *Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs* January 2002
- 3) A 10 cfm flow rate is a conservative estimate for flow rates from passively vented tanks - reference HNF-SD-WM-TI-797, Rev 3, Results of Vapor Space Monitoring of Flammable Gas Watch List Tanks.